NATURAL RESOURCES CONSERVATION SERVICE
(NRCS)

(210-AWMFH, Chapter 13, OH-8, 3/00)
ANIMAL COMPOSTING

LIVESTOCK MORTALITY COMPOSTING
Operation & Maintenance Plan
Windrow Composting With Sawdust

Owner _____ County _____ Date _____

Type of Livestock: Dairy/Cattle Horses Poultry Sheep/Goats Swine

Design Mortality (lb/day): _____

Design Carcass Weight (lb): _____

Primary Cycle _____ days (10 day min), Secondary Cycle _____ days (10 day min)

1. Composting is a controlled natural process in which beneficial microorganisms reduce and transform organic wastes into a useful end product (compost). It is an aerobic process that does not produce offensive odors, and does produce a final product that is safe and is valuable as a crop fertilizer.

2. This method utilizes sawdust as the carbon amendment and allows the dead animal to supply the necessary nitrogen and water for the composting process to take place. This will satisfy the requirements of certain readily available bacteria and fungi to convert these materials to an inoffensive and useful product. The volume of the mass will be reduced 25 to 30 percent by the process. The composting process consists of a primary and secondary stage. The primary stage is to reduce the carcass to where only larger bones remain. The secondary stage is to allow complete decomposition of the carcass and for the compost to stabilize. The composting time is dependent upon the size of the carcass. Therefore it is best to group similar sized carcasses into the same windrow. The time for secondary composting should generally be about 1/3 the time of primary composting. The following table can be used to estimate the cycle times for various sized animals.

Carcass size (lbs).	4	10	50	100	220	350	500	1000	1500
Primary cycle (days)	10	16	35	50	75	95	115	160	195
Secondary cycle (days)	10	10	12	15	25	30	40	55	65

3. Start a composting windrow by placing a minimum one foot of sawdust on the base of the area for the windrow; if the carcass weight exceeds 200 Lbs, use at least 1½ feet of sawdust at the base. Carcasses placed directly on soil, gravel, or concrete floors will NOT compost. Place one layer of dead animals on the sawdust and cover with a minimum of 2 foot of sawdust. Place no animals closer than 2 feet from the sides of the windrow. The 2 feet cover on the sides and on top is important to eliminate scavenging animals and minimize odors. Most problems in animal mortality composting arise when insufficient sawdust is used in covering carcasses. Small animals less than 20 pounds may be grouped. Larger animals may need to be recovered as the sawdust settles around the carcass. Shape or round the windrow so that it will shed rainfall. Do not allow pockets to form in the windrow and eliminate any areas that will trap water. As large carcasses begin to decompose the windrow will settle and form pockets; as this occurs the windrow must be reshaped.

To place additional carcasses, "hollow-out" a cavity in the existing windrow, place the carcasses one animal thick and cover with a minimum 2 foot sawdust. If finished compost is available, it should be used to cover the carcass to provide additional heat and bacteria to start the process. Sawdust should then be used to provide the final cover. Use a pointed dowel or rod to measure the thickness of the sawdust cover. Do not put carcasses on top of carcasses. Maintain 1/2 to 1 foot between carcasses to prevent a large anaerobic mass.

4. It is recommended to monitor the temperature in the windrow with a long stem, dial type thermometer. When composting is proceeding properly, temperatures will reach 130 to 160 degrees F. Other than testing, this is the best way to prove pathogen kill and identify problems. Primary windrows started during cold weather may not begin composting immediately. As temperatures warm up, composting will begin. There is usually enough heat in active compost to continue composting through cold weather, regardless of the ambient temperature. If sawdust is used as recommended, the insulation effect is sufficient to minimize the effects of ambient temperature. However during cold weather, incorporate mortalities into the compost as soon as possible. *Frozen carcasses will take very long to compost*.

5. After the primary windrow has composted for the “primary cycle time” (after adding the last animal), turn the contents into the secondary windrow. This step provides mixing and aeration of the material so it will reheat and compost through the secondary cycle. When composting animals in excess of 600 lb each, it is recommended that a separate pile be managed for each mortality to assure that the primary cycle time is reached before the pile is turned.

6. After the secondary cycle has completed, the compost should appear as a dark humus type material with very little odor. Some resistant parts such as teeth may still be identifiable, but should be soft and easily crumbled. If not, reintroduce them to the primary windrow. After completion of the secondary cycle, the compost can be recycled. or spread as per the utilization plan. Storage of compost for at least 30 days following completion of the secondary cycle will give additional management flexibility. This is particularly important where the primary plus secondary cycle is less than 90 days since land application may not be possible immediately following the secondary cycle.

7. Use the finished compost for a starter material over the new carcasses being composted in the primary area. This provides heat and bacteria to kick start the process. Experience has shown that up to 50% of the sawdust requirements can be filled using recycled, finished compost. However, plan to use sawdust in the amounts noted for starting up the operation until sufficient finished compost is available. It is important to recognize that as finished compost becomes available, 50% of the fresh sawdust requirement must be maintained for the system to function effectively.

8. Keep sawdust relatively dry. Generally, sawdust between 40 and 50 percent moisture works best. Sawdust will shed rainfall reasonably well if the windrow is mounded, with no pockets or depressions. Positive drainage must be maintained. All leachate and runoff must be collected and stored or treated in a manure storage system or filter area. However in a properly maintained windrow leachate will generally be absorbed into the sawdust surrounding the carcass.

During dry periods of the year the surface of the windrow can become too dry and sawdust can easily be blown off by the wind. A water source needs to be available to re-hydrate the windrow to prevent sawdust loss.

If other carbon amendments such as corn stover or chopped straw are used in the windrow, moisture loss will be more prevalent than with sawdust. A supplemental water source will be necessary to maintain the proper moisture content necessary for composting.

9. Keep the area around the windrows mowed and free of tall weeds and brush. Watch for any leaching that may occur. Using sawdust for the foundation of the primary windrow will help eliminate leaching.

10. Finished compost should be applied to supply N, P_20_5 and K_20 requirements. The nutrient requirements for any particular crop should be based on a current soil test. Compost application rates should be calculated on its nutrient content according to a recent laboratory analysis. In the absence of a laboratory analysis the nutrient content of the compost is estimated to be:

Total Nitrogen -	20 lbs/ton
Ammonia Nitrogen -	4 lbs/ton
Phosphorus	2 lbs/ton
Potassium	6 lbs/ton

Finished compost shall be applied as per the compost utilization plan.

11. In order to assure desired operation of the composting facility, daily records should be kept during the first several compost batches. This can be helpful in identifying problems that may occur. Record keeping can be discontinued when a desirable level of operation has been achieved. It is suggested to record daily, the amount of sawdust added, the weight of the dead animals, and the temperature of the compost.

12. Occasionally, composters will not heat up, or will produce odors or seepage. Composting is a biological process that depends on providing nutrients and an environment favorable for vigorous bacterial growth. Common mistakes are, failure to provide all the materials needed for energy and aeration, sloppy loading, insufficient cover over the animals, insufficient sawdust between the animals. These mistakes typically result in a dense, anaerobic mass and one in which energy is limiting. Turning the pile and adding DRY sawdust will remedy these problems. An exposed windrow will not need additional water. Daily records are the best way to diagnose problems.

13. Maintain a DRY, well drained, solid base for the windrow for two reasons; the base of the windrow will not turn anaerobic, and an all weather access can be maintained for daily loading. A wet compost area will be prone to failure.

14. Animals digging into the compost windrow CAN be a problem. Measures must be taken if this occurs to maintain biosecurity and a positive public perception. The easiest way to prevent this from occurring is to maintain two feet of cover over all dead animal parts. It may become necessary to fence or build a structure to eliminate scavengers from the windrow if they cannot be kept out. It is easier to maintain two feet of cover than to incur the additional cost of a fence or structure. Operation and management will determine the needs of the system.

15. Inspect compost area or structure when the structure is empty. Replace any broken or badly worn parts or hardware. Patch concrete floors, curbs, or gravel areas as necessary to assure proper operation and integrity. Examine roofed structures for structural integrity and leaks.

16. Keep all trees, shrubs, and flowers healthy in order to maintain a positive rural image.

The following is an acknowledgement by the landowner and operator of the operation and maintenance requirements, support from the Natural Resources Conservation Service, and approval by the local Soil and Water Conservation District.

Signatures

Landowner_____ Date_____

Operator_____ Date_____

NRCS_____ Date_____

SWCD_____ Date_____

Frequently Asked Questions

In answering questions, if answer applies to either a windrow or bin system the word pile is often used.

1. Doesn't a dead animal compost facility produce offensive odors, and attract rodents & dogs?

If carcasses are properly covered with two feet of sawdust, odors are sufficiently suppressed or absorbed so they are not a problem in most cases. When properly operated and managed, composters do not add to or increase odor levels around a production facility. Using too little sawdust is the single greatest factor associated with odor and rodent or scavenger problems. It is important to prevent these problems during start up because once scavengers learn the composter is a source of carcasses, they can be difficult to stop.

2. What happens in the winter time when temperatures are cold?

In general the warmer the ambient temperature, the better the composting process works. However, an active compost pile contains considerable heat which, with the insulating effect of sawdust, minimizes the effects of ambient temperatures. Interior pile temperatures of 130 to 160 degrees F are typical in properly operating composters when ambient temperatures are as low as zero degrees F. Cold or frozen carcasses placed in cold, fresh sawdust will not compost during cold weather. However, carcasses placed under these conditions will begin to compost as ambient temperatures increase in the spring.

Carcasses placed in an active compost pile during cold weather should begin to compost as heat is absorbed from the composting mass. Covering the carcasses with warm or hot finished compost from an active secondary pile will further enhance the composting of fresh carcasses in cold ambient temperatures.

3. Is a roof and concrete floor necessary?

It has been shown that a roof is not necessary when sawdust is used as the carbon amendment. Sawdust has the unique ability to shed water and if kept on a dry and well drained base, will not cause leachate. *Until research proves otherwise, a roofed structure will be required unless, 1. sawdust is used as the carbon amendment, and 2. an all weather, dry, positively drained composting surface is used and all weather access is maintained, and 3. the runoff and any possible leachate is collected and stored or treated in a storage or filter area.*

4. How large a carcass can be put in a composter.

Mature sows and boars (300 to 600 lb) and cattle (>1000 lb) have been successfully composted. Longer composting times are required for the larger carcasses. However, four months of active composting time should be sufficient for most swine carcasses. The carcasses are composted whole, no cleaving or cutting up is necessary. If certain parts such as the skull or ball joints are not fully composted, reintroduce them to the primary composting process for another cycle. If this is happening a lot, look for reasons the process is being slowed. Many times it is because not enough sawdust is being added to the system.

5. Do composters fail, and why?

Occasionally, yes. Composters may not heat, producing odors and/or creating seepage. Composting is a biological process that depends on providing nutrients and an environment favorable for bacterial decomposition. *Common mistakes are: 1. failure to provide enough sawdust to the system to provide for the bio-filter and to maintain an appropriate carbon source for the system to operate over time, or 2. placing carcasses too close together may create a large anaerobic mass that will need to be turned and dry sawdust added.*

- In windrow composting the pile must be well rounded to shed water and the base must be well drained and solid to allow for access and prevent anaerobic conditions.
- The problems with, too-wet, improperly mixed, or incomplete mixes of compost materials can be amended. When primary compost is turned, dry sawdust may be added to wet compost, and improperly mixed materials can be remixed. A little experience and perseverance usually give good results in a short time.

6. Can finished compost be used as a partial or full substitute for fresh sawdust in the primary windrow?

Experience to date indicates that up to 50% of the fresh sawdust requirement may be fulfilled with finished compost. The long-term viability of the process cannot be maintained if fresh sawdust is not added, because the source of carbon would eventually be exhausted. Advantages of recycling finished compost include: less fresh sawdust required, active bacteria and heat available in the finished compost, and less finished compost to haul for land spreading.

7. What about diseases, flies, and pathogens?

Fly breeding has not been a problem with composters. However, if positive drainage is not maintained, or rutting or ponding of water occurs, or the windrow is above 60 % moisture, flies will be a problem. The answer is the proper location and construction of the composting area so there is no free standing water, positive drainage is maintained to the collection area, and the windrows are rounded.

Exposed carcass parts will invite flies and scavengers, compromising biosecurity. Properly covering all carcasses with two feet of sawdust is critical.

Temperatures will rise above 135 degrees F for greater than a three day period, which has been shown to eliminate pathogens associated with swine production. No disease outbreak has been associated with composting to date. It is recommended that composting occur on site, eliminating the spread of disease associated with transporting dead stock. Spreading finished compost on fields or pastures helps assure that disease organisms do not find their way back to the production area.

8. What should finished compost look like?

Properly finished compost should appear as a dark granular material resembling humus or potting soil. It should have the feel of moist soil, and it may have a slight musty odor. Some resistant bones will be visible, but they should be soft and easily crumbled.

9. If I do not have sawdust available, can I use another carbon source?

YES, if you plan to compost in a roofed structure. If you plan to compost without a roof, until research discovers otherwise, sawdust is the only acceptable carbon source in Ohio to legally compost without a roof.

Any granular organic material with a high carbon content should be a candidate as an ingredient in composting. Successful swine composting without the use of a roofed structure has been accomplished using sawdust as the carbon amendment. More research and experience is needed to evaluate other carbon sources such as straw, hay, corn stalks, or rice hulls. A long fibrous material such as cornstalks or straw would likely work better for composting if it were ground to reduce the particle size, similar to that of sawdust. This would allow the material to settle around the carcass and provide the contact needed for good bacterial activity.

Composting structures for swine have been successful utilizing straw and poultry litter as the carbon and nitrogen source. It is necessary to construct a structure with a roof, concrete floor, and concrete or treated timber walls for these systems. Their success has been documented and design criteria are available.

10. What should I do with finished compost?

Finished compost in the secondary pile, not recycled to the primary pile, should be spread as per the compost utilization plan. Conventional "beater type" manure spreaders are ideal for handling and spreading compost.

11. Can I compost in just one step, rather than moving the material from primary to secondary windrows or bins?

Moving compost from primary to secondary windrows or bins provides mixing, adds oxygen, and allows the compost to "finish off" with a high degree of breakdown. The success of the primary/secondary approach has been demonstrated in many other areas of composting, as well as mortality composting. Some producers have reported acceptable results with single step composting, but the total composting time can be longer than the primary/secondary composting time. Also, bin or windrow volume requirements are not reduced by single-step composting.

12. What about using "green" or wet sawdust?

Generally dry sawdust is better since dryer sawdust can absorb more water and contains more air space. Producers have reported success using green sawdust for some or all of the fresh sawdust requirements. Sawdust containing excessive moisture may freeze in the winter, making it difficult to handle and place around the carcasses. A compost windrow with greater than a 60% moisture content increases the risk of leachate, anaerobic activity, and fly production. Aged sawdust of 40- 50% moisture content is recommended.